Virginia's Nonpoint Source Pollution (NPS) Management Program has long recognized the need to improve surface and ground water quality by reducing nonpoint source pollution associated with abandoned and orphaned mineral mines. Virginia's Department of Conservation and Recreation's Division of Soil and Water (VDCRSW), which administer the NPS program, recently had the unique opportunity to partner with the Virginia Department of Mining, Minerals and Energy's (VDMME) Orphaned Lands Program to support several innovative reclamation projects in order to achieve these water quality goals.

Cabin Branch Mine Orphaned Land Project

From 1890 to early this century, Cabin Branch Mine operated at a site located along Quantico Creek, a tributary of the Potomac River, in Prince William County, Virginia. Large by Virginia standards, the mine had 200 to 300 men working above and below ground at any given time, excavating pyrite for use in the production of sulfuric acid. The deepest shaft was reported to be 2400 feet deep with levels every 110 feet. Over 70 buildings supported the mine as well as a narrow gauge railroad that connected the mine to the wharves on the Potomac River.

The Site

Finally abandoned in the 1920's, Cabin Branch Mine and the land surrounding it was obtained by the Civilian Conservation Corp in 1933, and is now part of Prince William Forest Park. The park encompasses 18,633 acres covering a major portion of the Quantico Creek watershed, and contains one of the few remaining piedmont forest ecosystems in the National Park System. The area had been heavily farmed for tobacco since colonial times, leaving the soil degraded and subject to intense erosion. Since being acquired by the National Park Service, the native forest has been allowed to reclaim the over-farmed and exhausted landscape. However, the area incorporating the mine site had not been able to revegetate naturally because of highly acidic mine tailings inhibiting growth.

The abandoned mine site was located alongside a stream corridor popular with park visitors, and had become a source of numerous safety and environmental problems. These problems included the unvegetated mine tailings, acid producing pyretic materials on the creek bank and in creek sediments, open and improperly sealed shafts, and old process areas. Water quality in Quantico Creek just downstream was severely compromised due to the acid mine drainage and heavy metal contamination. During rain and storm events, surface water mobilized and carried oxidized sulphur compounds and acidic material into the creek. The resulting impacts on the water quality of the creek were elevated pH, high conductivity, and significant sediment loading.

Project Goals and Implementation

The primary goal of the Cabin Branch Mine Orphaned Land Project was to improve the water quality of the downstream reach of Quantico Creek contaminated by acid drainage and heavy metals. Additional goals included making the site safer for park visitors, and restoring native vegetation. Reclamation plans included diverting storm waters away from the mine site to limit acidification of off-site storm waters, dredging spoil materials from Quantico Creek, sealing all

shafts so surface water will not enter mine workings or groundwater, covering mine spoil materials with good soil medium, and revegetating all disturbed areas with tolerant grasses and legume species. All of these actions were designed to reduce acid mine drainage discharges, thereby reducing heavy metal concentrations in the surface waters.

The abandoned mine's location in a popular National Park not only made reclamation a high priority due to environmental and safety concerns, it also provided a unique opportunity for public outreach and education. Keeping this goal in mind, the proposed project was designed to demonstrate several reclamation techniques that could be adapted to similar mine sites throughout the state of Virginia. During and after reclamation, park visitors and the local community would be educated to the dangers associated with abandoned mine lands, the ecological impacts of non-point source pollution, the role of DMME's Orphaned Land Program, and the benefits of ecological reclamation. Community involvement with the project would also stressed in order to build on the local community's interest and interaction with the Park.

Highlights of Project Results

Water chemistry monitoring of Quantico Creek was conducted before and after reclamation of the Cabin Branch Mine site in order to quantify success of the reclamation project. Initial water sampling taken after reclamation activities were completed showed a marked decrease in the presence of heavy metal contamination in Quantico Creek. A two-year monitoring program conducted by George Mason University recently confirmed that levels of copper, zinc and iron in the stream have been appreciably reduced since project completion. Sulfate levels and conductance have also improved. In addition, remotely sensed images taken by the US Corp of Engineers pre- and post-reclamation visually illustrate the elimination of acid materials from the creek itself. The George Mason study also included fish and invertebrate sampling of the stream. The fish community in the downstream reach has increased in both number of taxa and number of individuals since the project was completed. Results of invertebrate monitoring are inconclusive because of large population fluctuations during the monitoring period.

In addition to the monitoring program developed for the project, a unique partnership evolved subsequent to reclamation between the Park's resource management staff and United States Geological Service scientists. The USGS geologists, interested in groundwater hydrology on the Cabin Branch Mine site, have conducted soil-pH surveys, geoelectrical surveys, solid material characterization and radiogenic isotope studies. Results confirm that project design elements intended to divert contaminated surface water from groundwater resources has been successful. The Park's resource management staff also teamed up with the USGS staff to initiate a monitoring and research study to investigate the impact of stormwater retention ponds, created during the reclamation project in order to minimize acid mine drainage from the site, on breeding amphibians. While high pH levels and heavy metal concentrations within the surface water retention ponds have been shown to negatively impact amphibian reproduction, results of this study confirm that the ponds are doing what they were designed to do---trap contaminants from surface mine drainage and keep it from reaching Quantico Creek. This study is now nearing completion and represents a unique opportunity for scientists to study the impact of low pH and heavy metal contamination on amphibian breeding under field, rather than laboratory, conditions.

The public outreach activities integral to the project continue to be a success. Community involvement was high, and at the end of the project 150 volunteers gathered at the reclamation site to plant 5000 native trees and shrubs. This effort will help further stabilize the stream bank and assist in restoration of the native forest to previously bare ground. The volunteers

represented a diverse cross-section of the community, including Boy Scouts, local schools, conservation, and other citizen groups. The trail to the abandoned mine site has been reopened, and a boardwalk and viewing platform have been installed at the site itself. Interpretive signage is currently being developed. In addition, a special Ranger program about the Cabin Branch Mine is being offered several times throughout the year. During this program, entitled 'Go Back'n'Mine', groups of park visitors are led by a Park Ranger on a two-mile hike to explore the remains of the mining operation and learn about the Park's reclamation of the site.

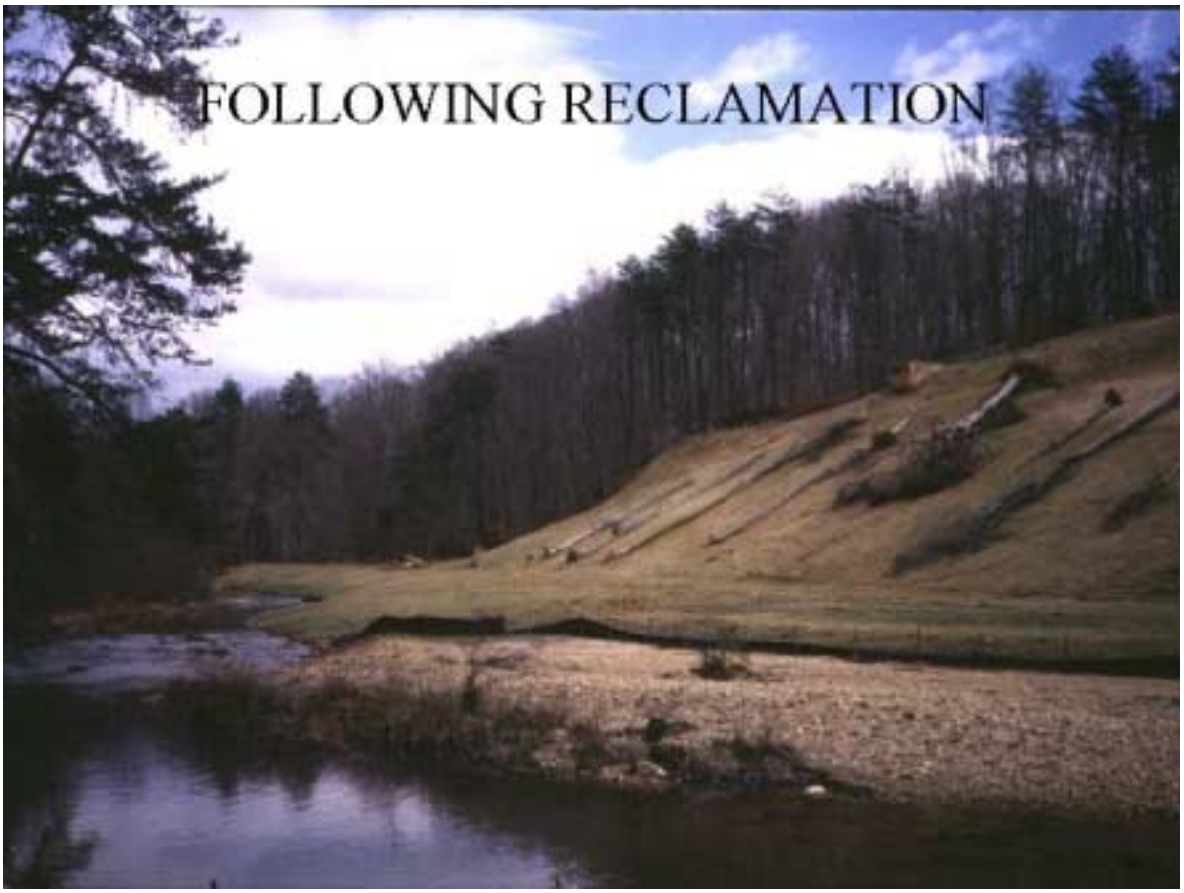
And finally, as part of the research project on amphibian reproduction within the stormwater detention ponds at the reclamation site, a park wide amphibian monitoring program was initiated. This program includes a dynamic educational component consisting of a brochure, an intranet page, an interactive CD-ROM, and a detailed training manual. Interpretive staff is also developing additional amphibian programs.

Project Partnerships and Funding

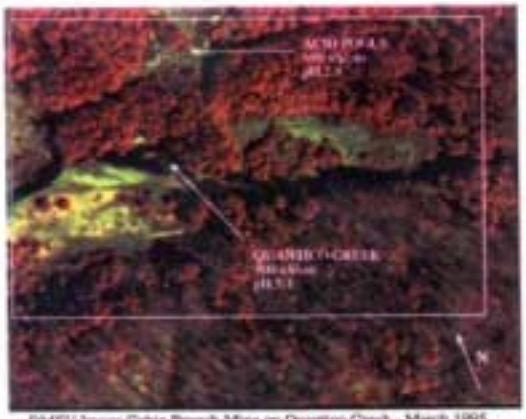
The Cabin Branch Mine site was reclaimed in 1995 after years of coordination between the National Park Service (NPS) Geologic Resources Division, NPS Water Resources Division, Virginia Department of Mines, Minerals and Energy, and the natural resources staff at Prince William Forest Park. The project was funded in part by EPA's Nonpoint Source Pollution Control Program administered by the Virginia Department of Conservation and Recreation's Division of Soil and Water. Funding included a $75,000 Section 319 Grant, a $40,000 grant from the National Park Service Water Resources Division, with the balance covered by Virginia's Orphaned Land Program administered by the Virginia Department of Mines, Minerals and Energy's Division of Mineral Mining. The VDMME's Orphaned Land Program has identified over 3000 abandoned mines other than coal mines since the programs inception in 1978. The inventory program is continuing to identify orphaned mines throughout the Commonwealth, in part with funding from an additional grant from the VDCRSW's Nonpoint Source Management Program.

Information about visiting the Prince William Forest Park and the Cabin Branch Pyrite Mine site, as well as dates and times for the "Go Back'n'Mine" program, can be found at the Park's website at http://www.nps.gov/prwi/ .

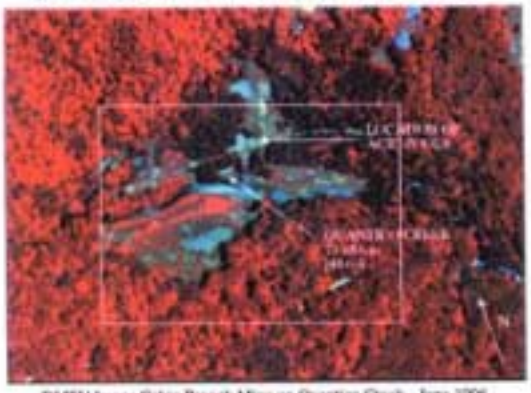
REMOVAL OF SPOILS ON CREEK BANK



FOLLOWING RECLAMATION



DMSV Image Cabin Branch Mine on Quantico Creek - March 1995
Spectral Bands: 450nm, 650nm, 750nm (BGR) .50cm/pixel GSD



DMSV Image Cabin Branch Mine on Quantico Creek - June 1996
Spectral Bands: 450nm, 650nm, 750nm (BGR) .75cm/pixel GSD